AI Love You

Yuefang Zhou • Martin H. Fischer
Editors

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Developments in Human-Robot Intimate
Relationships

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To Yidi

Preface

As we move headlong through the twenty-first century and into the future, achievements in artificial intelligence (AI) continue at an exponential speed. AlphaGo, AlphaGo Zero, and AlphaZero algorithms have already defeated the best human game players in the world (Silver et al., 2016, 2018). Within this rapid transformation, our relationships with digital technologies—and, consequently, with ourselves—are also undergoing a fundamental transformation. Under this transformation, we are, for the first time in human history, forced into the position of redefining the boundaries of human desire, as technological advancements create new possibilities for human sexuality.

Science fiction writers have long whetted our appetite for wonder. Today, some of our most advanced intelligent machines, their minds equipped with AI and their bodies made from life-like silicon and frubber®, are gradually stepping into our private sphere of life (Nature, 2017). Dreams of "forever in love" and instant sexual gratification have never looked so close to reality as at the present time. Consider *Harmony*, the female companion robot made by the Realbotix™ company, whose body and personality can be tailor-made to suit whatever personal needs and sexual preferences we wish see the chapter "Living with Harmony: A Personal Companion System by Realbotix™") or the hologram girls who can be made permanently available to satisfy their owners' emotional needs and desires see the chapter "Hologram Girl").

As we continue to explore the road towards a sexual future with robots, many central questions are calling for urgent empirical answers. Is the current, or near-future, technology capable of simulating genuine loving and sexual relationships between humans and intelligent machines? To what degree are we prepared to accept the idea of developing intimate relationships (i.e. emotional attachment and sexual interaction) with artificial partners? What are the potential benefits and likely challenges to individuals and to society as a whole if we engage in loving and sexual relationships with artificial partners? What role(s) will empirical research play in understanding this emerging phenomenon? This book sets out to provide the philosophical, technological, and psychological tools to better consider some of these important questions.

In recognition of this urgent need to discuss and resolve questions around the future of artificial emotional intelligence, we recently organized an international workshop on the theme of human-robot intimate relationships. The workshop was held at the University of Potsdam in Germany on the 8th December 2017. It brought together an interdisciplinary team, including psychologists, philosophers, computer scientists, ethicists, and clinicians, as well as interested members of the general public, to discuss the questions listed above. The workshop has served as a first serious attempt to respond to the urgent call disseminated in a *Nature* editorial (2017) to conduct empirical research so that public debates around this topic can be more evidence-based.

This book builds on the presentations delivered at the workshop. It aims to present the most up-to-date theoretical and technological understandings of human-robot intimate relationships, as well as associated potential benefits and likely consequences. The book is divided into five parts.

Part I deals with the topic of how we interact with artificial partners. Drawing evidence from media psychology, sexual sciences, and social sciences, broadly, the *Sexual Interaction Illusion Model* is introduced in the chapter "Negative and Positive Influences on the Sensations Evoked by Artificial Sex Partners: A Review of Relevant Theories, Recent Findings, and Introduction of the Sexual Interaction Illusion Model" to describe key psychological concepts in sexual interactions with artificial entities. The chapter "Intentionality but Not Consciousness: Reconsidering Robot Love" takes a philosophical perspective on the mind, in that robots can be viewed as having intentionality, but not consciousness, to defend the possibility of robot love. The chapter "The Use of Social Robots and the Uncanny Valley Phenomenon" discusses, from a psychological perspective, the causes and possible effects of the uncanny valley phenomenon on human-robot interaction in a social domain. These first three chapters in Part I provide the reader with a number of theoretical approaches to understand the nature of our social interaction with robots.

Part II addresses the issue of technological readiness to enable humanoid robots to take on the role of our artificial partners. The chapter "Living with Harmony: A Personal Companion System by Realbotix™" introduces the example of a personal companion system, the previously mentioned *Harmony* from the Realbotix™ company, by detailing its current and near-future state of technological development and user experiences. The chapter "Readable as Intimate: Toward a Conceptual Framework for Empirical Interrogation of Software Implementations of Intimacy" investigates the possibility and challenges of simulating a compelling human-machine affective interaction. In contrast with the sentiment of the previous chapter, the authors argue that the current and near-future technology is not sufficiently ready to simulate intimacy if it were to include mutual self-disclosure and vulnerability over time. The chapter "From the Mind to the Cloud: Personal Data in the Age of the Internet of Things" explores the challenges of personal data protection in the age of the Internet of Things (IoT). Drawing parallels between examples from autonomous driving and social robotics, the authors discuss whether or not social robots should be considered autonomous intelligent agents while the challenge of personal data control and protection continues.

Part III describes some likely future developments in this area. In the chapter "Building Better Sex Robots: Lessons from Feminist Pornography", the author takes cues from historical feminist pornographers to argue that sex robots can be better made to challenge gendered norms and assumptions about male and female sexual desires by changing the content, process, and context of sexbot development. The chapter "Hologram Girl" discusses the possibility that holograms can serve us as objects of desire, alongside love dolls and sex robots. This section of the book provides food for thought on the wide range of future, unexplored digital relationships.

Part IV presents sections of an open discussion at our international workshop, exploring some clinical implications of using sex robots for human benefits, in particular the potential role of sex robots in reducing instances of pedophilia. While the discussion was inspired by a specific presentation from a clinical psychologist, its content reveals the importance of a wider dialogue based on firm evidence from basic research.

The book concludes with Part V which speculates on the feasibility and direction of the relationship between humans and humanoid robots, highlighting the importance of a scientific and transdisciplinary approach in understanding this emerging phenomenon.

This book is for everyone from researchers in the cognitive sciences to educational and clinical practitioners, philosophers, ethicists, roboticists, policy-makers, and really anybody interested in this area; we hope it will provide insights and inspirations and shed light on the relationship between artificial intelligence and social changes on the horizon.

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About the Editors

Yuefang Zhou is a postdoctoral visiting scientist to the University of Potsdam in Germany and was a visiting scholar to the Charité Institute of Sexology and Sexual Medicine, Charité - Universitätsmedizin Berlin in Germany (2017–2018). She holds a master with distinction in Applied Research Methods from the University of Dundee, UK. After completing her Ph.D. at the University of Dundee in 2007, she first worked in social psychology on group identity in the University of St Andrews in 2008 and then in the area of Health Psychology in the Medical School of the University of St Andrews (2008–2017). In St Andrews, she strengthened her expertise on studying human interactions in medical settings and developed a keen interest to study human-robot social interactions, to which she is currently devoting her full attention.

Martin H. Fischer is professor of Cognitive Science, chair of Cognitive Sciences at the University of Potsdam in Germany, and speaker for the research focus on Cognitive Sciences at this university. After completing Psychology studies at RWTH Aachen, Germany, in 1991, he worked in Massachusetts, USA, on human motor activity and eye movements. Following his Ph.D. in Cognitive Psychology, he worked as a researcher at LMU in Munich, Germany, before moving to the University of Dundee in Scotland in 1999. There, he worked for 12 years on various topics, including human-robot interaction, before being appointed in Potsdam. Leading the Potsdam Embodied Cognition Group (PECoG), he has recently published the two-volume *Foundations of Embodied Cognition*.

About the Authors

Oliver Bendel who was born in 1968 in Ulm, is an expert in the fields of information ethics and machine ethics. After completing his degree in Philosophy and German Philology (MA), as well as in Information Science (Diploma in Information Science) at the University of Konstanz, and after his first professional experiences, he did his doctorate in Information Systems at the University of St. Gallen (Dr oec). He has been working in Germany and in Switzerland as a project manager for new media and as a supervisor of the engineering and science departments of several universities. Today, he lives in Switzerland, working as a freelance writer and as a professor at the FHNW School of Business.

Kino Coursey, Ph.D. is chief AI researcher at Realbotix™. He is a computer scientist with a broad background ranging from developing communications technology to designing evolutionary and neural systems. He was a member of the design committee for the AIML (AI Markup Language) chatbot language and has designed and implemented numerous AI systems using commonsense reasoning, evolutionary, and neural systems. He has been a technical consultant for Hanson Robotics, RoboKind, Motorola, and IBM and worked on the natural language processing of Philip K. Dick, BINA-48, and the Sophia androids. He has received National Science Foundation grants for developing the computational compassion architecture and applying personal humanoid robotics to language learning and teaching interactions to autistic children.

John Danaher is a lecturer in the Law School at NUI Galway, Ireland. His research interests lie, broadly, in the areas of philosophy of law and emerging technologies and law. In the past, he has published articles on human enhancement, brain-based lie detection, philosophy of punishment, robotics, and artificial intelligence. He maintains a blog called Philosophical Disquisitions and also writes for the Institute for Ethics and Emerging Technologies. He is the coeditor (along with Neil McArthur) of *Robot Sex: Social and Ethical Implications* (MIT Press, 2017) and the author of *Automation and Utopia: Human Flourishing in a World Without Work* (Harvard University Press, forthcoming 2019).

Martin H. Fischer   is professor of Cognitive Sciences at the University of Potsdam. He obtained his Ph.D. in Cognitive Psychology from the University of Massachusetts and worked in Dundee/Scotland before returning to Germany. He studies various aspects of cognition from an embodied perspective, including attention, numerical cognition, language comprehension, and movement planning. Recently, he coedited the two-volume *Foundations of Embodied Cognition*.

Tilo Hartmann, Ph.D.   is currently an associate professor at the Department of Communication Science, Vrije Universiteit Amsterdam. In his research, he applies media-psychological approaches and methodology to study the experience and perceptions of media users, including mediated illusions (e.g. parasocial interaction, presence, virtual violence), and media users' choices and preferences. He is editor of the book *Media Choice: A Theoretical and Empirical Overview* and served as editorial board member of *Journal of Communication*, *Human Communication Research*, and *Media Psychology*.

Martin Hudák, Ph.D.   works as a researcher in Intelligent Transport Systems (ITS) in the ERAdiate team at the University of Žilina. He currently participates in two European projects, FP7 ERA Chair ERAdiate and H2020 MoTiV, contributing to project dissemination and exploitation activities. His research activities and interests cover urban transport analysis, enterprise information, innovation management, software engineering, digital marketing, and web design. He received a Master of Science degree in E-commerce and management and a Ph.D. degree from the Faculty of Operation and Economics of Transport and Communications at the University of Zilina. His Ph.D. thesis, titled "The economic impacts of visual smog in transport", investigated the behavioural effects and economic impacts of visual smog on drivers, tested with eye tracking glasses.

Matúš Ivančo   is a Ph.D. student at the Department of Security Management, Faculty of Security Engineering, University of Žilina. He is a technical expert with several certifications (such as CCTV technology, Paradox Security Systems). His research interests include security of information systems, protection of critical infrastructure, and cybersecurity. His doctoral dissertation deals with the resilience of elements of physical protection against terrorist attacks.

Viktor Kewenig   is a graduate member of the Faculty for Experimental Psychology at the University College London. He currently works with Gabriella Vigliocco on the role of iconicity in the emergence of language. Before that, he was part of various labs, including the Potsdam Embodied Cognition Group (PECoG) and the Brain Language Laboratory. Having specialized in the Philosophy of Mind and Language at the University of Cambridge, he has an interdisciplinary understanding of Cognitive Science. His contribution to this volume is a position paper, scrutinizing the debate around the possibility of sex robots.

Nicole C. Krämer is full professor of Social Psychology, Media and Communication, at the University of Duisburg-Essen, Germany. She completed her Ph.D. in Psychology at the University of Cologne, Germany, in 2001 and received the venia legendi for psychology in 2006. Her research focuses on social psychological aspects of human-machine interaction (especially social effects of robots and virtual agents) and computer-mediated communication (CMC). She heads numerous projects that received third-party funding. She served as editor in chief of the *Journal of Media Psychology* (2015–2017) and currently is associate editor of the *Journal of Computer-Mediated Communication* (JCMC).

Katharina Kühne is a member of the Potsdam Embodied Cognition Group (PECoG). She has a master's degree in Linguistics (Free University, Berlin, Germany) and a master's degree in Cognitive Psychology (Potsdam University, Germany). Her research interests are embodied language processing, bilingual language processing, social robotics, and cognitive neuropsychology.

Kit Kuksenok holds a Ph.D. in Computer Science and Engineering from the University of Washington (UW), based on research of code work practices in academic software groups. Aside from studying software development practices at UW and later at the Hasso Plattner Institute, he has worked on machine learning and natural language processing applications, in a variety of academic and industry institutions, with the aim to improve the transparency and understandability of automated or semiautomated systems. The focus on the production process of software and knowledge of contemporary tools underlying smart conversational interfaces informs his contribution to this volume, a conceptual framework to assess the technical readiness of sex robots for intimate relationships with their human users.

Guile Lindroth is the chief AI and content specialist at Realbotix™ and has been working with AI, chatbots, and virtual assistants for the past 15 years. He is the founder of NextOS, the company behind Virtual Assistant Denise, and is motivated by the dream of building an intelligent nurse companion for the handicapped, elderly, and children. As a system analyst and AI and computer graphics specialist, he is the one behind Harmony dialogs, content, and narratives with the goal of one day teaching Harmony the "meaning of love, respect, and friendship".

Tomáš Loveček is the head of the Department of Security and Safety Research at the University of Žilina. In his role, he is active in the establishment of local and international collaborations, involving a variety of stakeholders. His research activities deal with improving crisis and security management in public administration and private enterprises and increasing the level of fire safety and quality of rescue services and with the complex provision of person, property, information, and environment protection.

Giuseppe Lugano, Ph.D. works as a senior researcher in Intelligent Transport Systems (ITS) in the ERAdiate team at the University of Žilina. He is the project

manager of the H2020 project "Mobility and Time Value" (MoTiV) and work package leader of the FP7 Pilot ERA Chair project ERAdiate on ITS. He has an extensive experience in the management of trans-disciplinary European-wide projects, gained while working as a science officer at COST (European Cooperation in Science and Technology) and as contributor to the R&D activities of ICT multinationals, such as TeliaSonera and Nokia. He holds a Ph.D. in Cognitive Science from the University of Jyväskylä, in Finland, and an MSc in Computer Science from the University of Bologna, in Italy.

Yuri Furuushi is co-founder of NextOS and leading programmer of the Realbotix™ application. He is a multiplatform developer and is responsible for design and implementation of the Harmony application on all platforms. He is a self-taught programmer with a degree in Digital Games and has dedicated the past 10 years acquiring the various applied skills required in technologies from AI to VR that make the Harmony project possible.

Matt McMullen is founder and CEO of Realbotix™. He is also the artist and design director. He started Abyss Creations, the manufacturer of Realdoll, out of his garage in 1997. Since then, he has been creating "the world's finest love dolls", as well as undertaking multiple custom projects. His dolls have popped up on more than 20 television shows and also co-starred in ten films.

Melinda A. Mende is a member of the Potsdam Embodied Cognition Group (PECoG, Division of Cognitive Sciences, University of Potsdam, Germany). She participated in the workshop "AI Love You" hosted by the editors of this volume in December 2018 at the University of Potsdam. She holds a bachelor's degree in Linguistics (University of Constance, Germany) and a master's degree in Mind and Brain (Berlin School of Mind and Brain, Humboldt University Berlin, Germany). Her research interests are numerical cognition with a focus on cognition of negative numbers and social neuroscience and social robots.

Susan Pirzchalski is director of Engineering at Realbotix™. She has more than 20 years of experience in system design and engineering (including both software and hardware development), from telecom systems to secure network monitoring equipment to customer-facing retail kiosks. She is responsible for all of the electrical, mechanical, and firmware components the company makes. She views the project as a means of applying her acquired skills towards her first technical love: robotics.

Stefania Santagati holds a Master of Science from, and is currently a research assistant at, the IT University of Copenhagen, where she investigates ethical implications of data processing. As an interdisciplinary scholar, she brings together humanities and design-oriented approaches to the study of information systems, drawing from critical technical practice, science and technology studies, and human-computer interaction. Her research reads engineering practices through

cultural insights and understands smart technologies in their sociocultural context, focusing on the ways in which intelligence and computation, their overlappings and specificities, and their possibilities of coexistence are conceptualized in the discursive construction around AI. Her work strives towards sustainable and flourishing relations between humans and intelligent machines, an approach that informs her contribution to this volume.

Jessica M. Szczuka is a postdoctoral researcher at the Department of Social Psychology: Media and Communication of the University Duisburg-Essen (Germany). She studied Applied Cognitive and Media Science and received her Ph.D. for her thesis about the social effects of sexualized robots (Title: "Let's talk about Sex Robots: empirical and theoretical investigations of sexualized robots"). Dr Szczuka's empirical research focusses on digitalized sexuality and communication with artificial entities (e.g., in terms of dialogue systems and artificial intelligence).